Workshop Manual

Fox 2004 ➤ , Fox 2010 ➤ , Fox 2014 ➤ ,
Gol 1995 ➤ , Gol 1999 ➤ , Gol 2006 ➤ ,
Gol 2009 ➤ , Gol 2013 ➤ , Gol 2017 ➤ ,
Golf 1999 ➤ , Golf 2007 ➤ ,
Golf 2016 ➤ , Golf BR 2018 ➤ ,
Kombi 1997 ➤ , Parati 1999 ➤ ,
Parati 2006 ➤ , Polo 2003 ➤ ,
Polo 2007 ➤ , Polo 2012 ➤ ,
Polo BR 2018 ➤ , Polo Sedan 2003 ➤ ,
Polo Sedan 2007 ➤ ,
Polo Sedan 2012 ➤ , Saveiro 2000 ➤ ,
Saveiro 2006 ➤ , Saveiro 2010 ➤ ,
Saveiro 2014 ➤ , Saveiro 2017 ➤ ,
SpaceFox 2006 ➤ , SpaceFox 2011 ➤ ,
T-Cross BR 2020 ➤ , Virtus BR 2018 ➤ ,
Voyage 2009 ➤ , Voyage 2013 ➤ ,
Voyage 2017 ➤ , up! 2014 ➤ ,
up! BR 2018 ➤

Wheels and Tyres - General information

Edition 03.2019

List of Workshop Manual Repair Groups

Repair Group

00 - Technical data

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

Contents


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00 – Technical data

1 General notes on rims and tyres (passenger vehicles)

(VRL012847; Edition 03.2019)

This information that follows aims to help you in case of tyre damage and complaints.

This chapter handles technical information regarding tyres and wheels.

Tyres are technologically advanced products, optimized for conditions of use in modern vehicles.

As with all products resulting from advanced technological development, these also must be handled with care. It is the only way to ensure safety, durability and driving comfort for the entire useful life of the tyre.

Tyres are subject to a process of constant evolution. Modern building techniques, manufacturing processes and permanent quality control produce tyres of a high standard of quality. All tyres recommended by Volkswagen have been tested by the department of technical development and have been optimized for the type of vehicle on which they are to be used, in co-operation with the manufacturers.

For this reason, if a tyre must be replaced we advise using a product of a brand we recommend.

Vehicle safety is our foremost priority. Considering different conditions of use, such as:

- different speeds,
- wet or dry surfaces,

During their life, tyres must meet many different use requirements. For this important reason, the basic prerequisites for the best possible use of tyres have been compiled in one place.

Correct adjustment of the axle geometry is a crucial factor to ensure maximum durability of the tyres. Thus, the adjustment of the axle geometry must remain strictly within the indicated tolerance limits.

Information on measuring the axle geometry of the vehicle ⇒ Running gear, axles, steering; Rep. gr. 44 ; Vehicle measurement, wheels, tyres .

Note

The causes of tyre damage and of complaints may be diverse. It is therefore very important to know whether the complaint originates in the tyre or in other components.

The normal tyre wear alters its characteristics. This may result in noises and driving instability. These are not considered damages as in faults, but they are signs of wear which may, by taking objective action, be at least partly eliminated. Driving noises can be 100% eliminated, in some cases.

1.1 Technical conditions for combining rims and tyres

- Combination and alterations shown in each vehicle's table refer only to original Volkswagen wheels
- Rim/tyre combinations or alterations with wheels acquired in the auto parts trade cannot be homologated.
- Radial tyres without inner tube may be mounted on oblique rim shoulders with safety shoulder, for example rounded shoulder.
- When using a rim/tyre combination, the respective tyre calibration values must be complied with. Tyre calibration values are indicated on a label on the inside of the fuel tank's nozzle compartment lid or in instruction manuals and service manuals for each vehicle.
- Front and rear wheel must be of the same manufacture type and size. In four-wheel-drive vehicles, always use tyres of the same brand and tread.

1.2 Miscellaneous

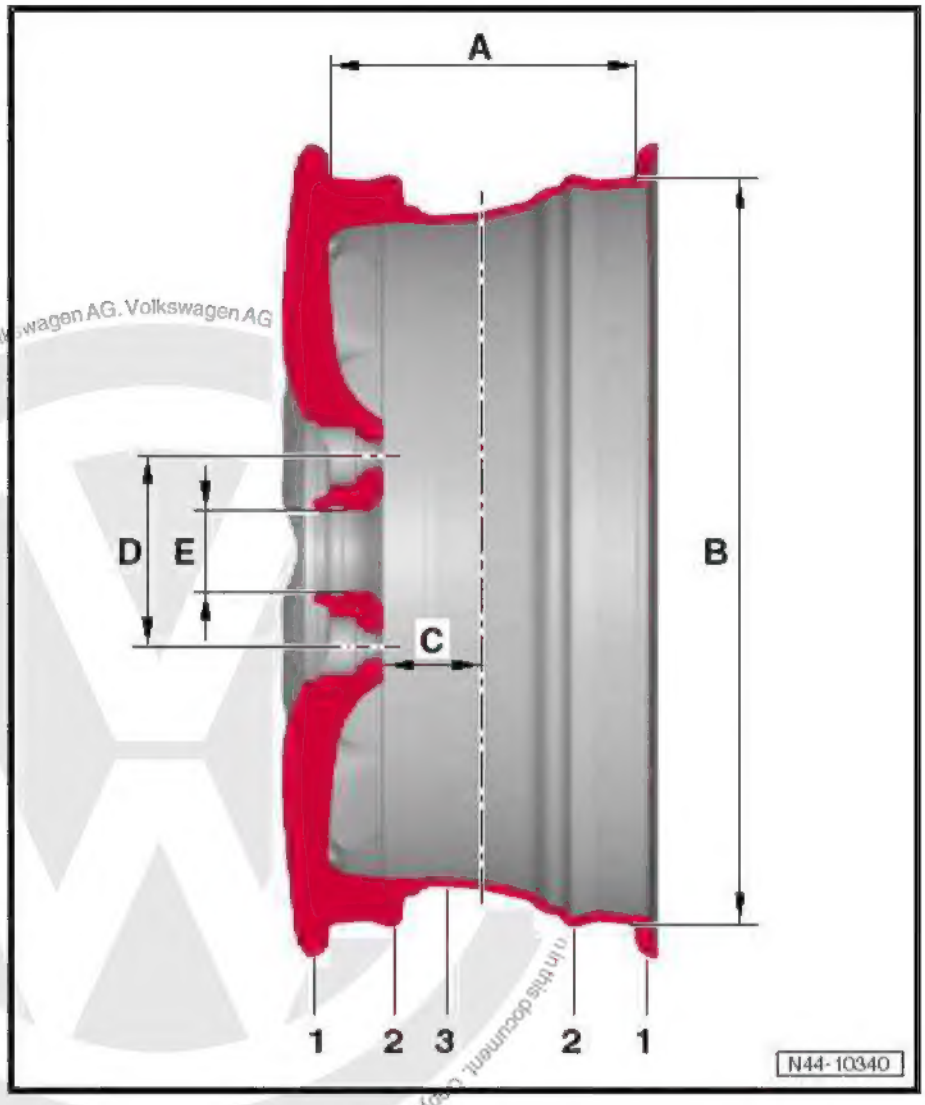
1.2.1 Wheel bolts - Tightening torques

To obtain the tightening torques for the wheel bolts, please refer to ⇒ Chassis, axles, steering; Rep. gr. 44 ; Wheels, tyres, vehicle dimensions (wheel alignment)

1.2.2 Wheel hole circle diameter

Hole circle diameter	Models		
100 mm	Gol G4 / Parati G4	Saveiro G4	Up!
	Fox	SpaceFox	CrossFox
	Polo	Golf	Gol / Voyage / Saveiro (5U)
112 mm	Kombi		

1.2.3 Wheel specifications



1- - Rim bead

Tire side bead rest

2– - Curvature (H2) in both rim shoulders

Prevents the tire from sliding the rim shoulder in sharp curves

Elevated curvature (EH2) prescribed for the use of rims with emergency operation characteristics

3- - Rabbet

Facilitates tire assembly

A- - Rim opening width

Distance between tire rest surfaces of both rim edges

Measurement in inches

B- - Rim diameter

Distance between the resting surfaces of the opposing tire shoulders

Measurement in inches

C- - Insertion depth

Distance between the wheel's vertical middle and the internal wheel rest surface

Measurement in millimeters

D- - Hole circle diameter

Diameter of the circle with wheel bolt holes

Measurement in millimeters

E- - Central hole boring

Works as centering

Measurement in millimeters

Different specifications may apply to the wheels. The specifications necessary to correctly identify the rim may be seen in the following example:

Part number:	6E0 601 027 A
Rim dimensions:	6 J x 15 6 - Dimension of rim width in inches J - form of the tyre edge 15 - rim diameter in inches.
Distance between the centre and the rim contact face (ET) in mm:	43 (Offset)
Salience data for rim shoulder:	EH2 extended salience [1)]

1) Salient round shoulder on both rim shoulders. These are intended, when using a tyre with the characteristics of an airless emergency tyre, to prevent it from jumping from its fit on the tyre shoulder. Wheels with EH2 are necessary only when tyres with emergency characteristics are mounted!

1.3 Remove the tyre from the arch

Please contact the manufacturer if your tyre assembly kit has not been adapted.

Safety instructions for tyre assembly and disassembly.

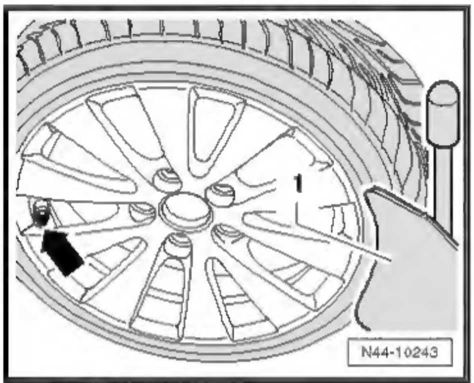
- Always follow the instructions and guidelines provided below.

– Empty the tyre. Carefully remove the fill valve stem.

– When pressing the tyre in a tyre assembly machine with assist arm, ensure the tyre valve -arrow- is placed on the opposite side of the assist arm -1-.

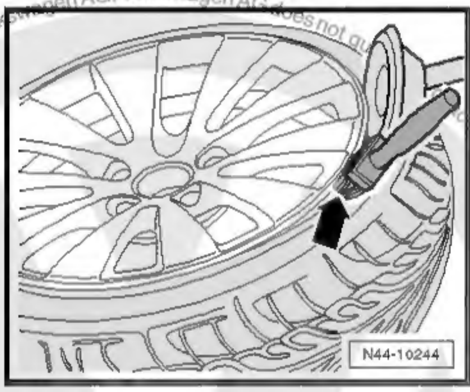
The assist arm may be positioned at a maximum distance of 2 cm from the wheel arch trim.

– Remove the balancing weights and dirt from the wheel.



– Remove (detach) both tyre beads across the entire circumference and apply wheel assembly paste between the tyre and the wheel arch -arrow-.

– Remove the tyre from the arch.



1.4 Install the tyre in the arch

- Ensure both the arch and the tyre are clean.

Please contact the manufacturer if your tyre assembly kit has not been adapted.

– Install the tyre in the arch.

– Use the -VAS 6459- -1- to insert a new tyre fill valve.

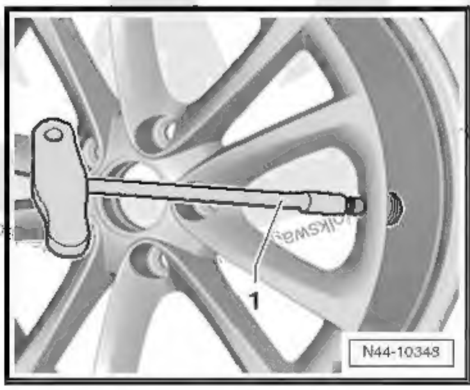
– Remove the fill valve stem.

– Fill the tyre up to approximately 3 ... 4 bar; the tyre bead must audibly slide over the arch.

– Install the valve stem.

– Fill (calibrate) the tyre as per respective specifications.

– Balance the wheel.



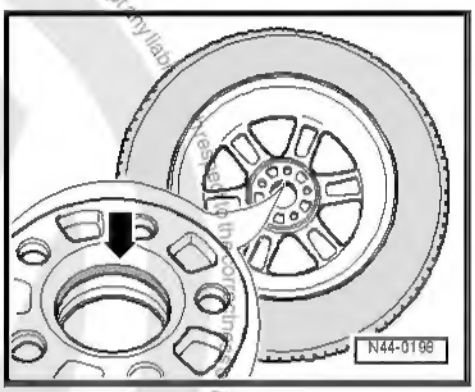
1.5 Protecting the wheel centering seat against corrosion

Can be used in all light alloy wheels and steel wheels.

If the wheel is replaced, the wheel centring seat must be washed with Cleaning spray - D 322 000 A2- as a preventive measure against corrosion between the wheel centring seat and the wheel rim. Refer to the ⇒ Chemicals Manual.

- Remove the wheel.
- Clean the centering seat in the wheel hub and the wheel rim centering thoroughly.
- Apply wax on the centering area -arrow - with a brush.

Be sure to wax only the centering -arrow - and not the wheel ring stop. Otherwise, this will cause dirt build-up on the brake surface when the vehicle is moving, which may cause poor braking action.



> **WARNING**
>
> *The wheel bolts, wheel stop/hub surfaces and wheel hub threads should not be waxed. Never apply lubricants or anti-corrosion agents on the wheel bolt threads.*

- Install and fasten the wheel .

2 Curiosities about rims and tyres (passenger vehicles)

2.1 Wear/tyre mileage

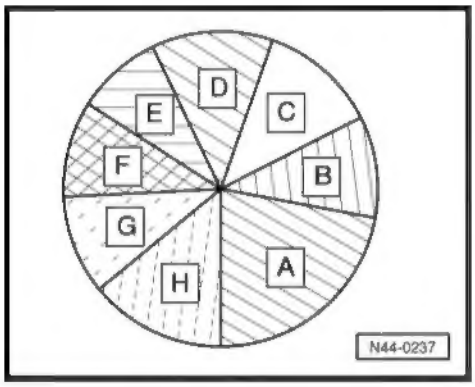
2.1.1 Miscellaneous

Tyres must meet uncountable needs ⇒ page 6 .

Each need is already partly considered in the tyres.

From tyres of types H, V and Z for "higher motorization vehicles" high adherence is expected, even on wet surfaces or in aquaplaning conditions. Conversely, total mileage obtained with this manufacturing concept cannot be as high as that obtainable with tyres of types S or T.

2.1.2 What a tyre must provide



A - Good braking behaviour on wet road surface

B - Driving comfort

C - Precise steering

D - Driving stability

E - Tyre weight

F - Durability expectation

G - Road resistance

H - Aquaplaning

The circular surface shows a tyre's suitability. It indicates in what way need factors from A to H can be incorporated in the structure and rubber mix of the tyre.

Improving performance in relation to a certain need may entail neglecting another need.

Example:

Improving braking behaviour on a wet roadway -A- entails a reduction in driving comfort -B-, in road resistance -G- and in expected life (durability) -F-.

Tyre durability in passenger vehicles does not depend solely on rubber mixture and tyre construction type. Conditions of use, the specific vehicle's conditions and the driving style also impact decisively the kilometres a tyre may travel over its life.

Modern vehicles equipped with adequate motorization allow both a careful, economical driving style, as a more sporty behaviour. Distances driven with the tyres can be from 5,000 to 40,000 km.

Note

Driving style is the one factor that most impacts tyre's durability.

2.1.3 Wear behaviour of high speed tyres

These tyres were developed to run at higher speeds. For this reason, their design emphasizes good adherence on wet road surfaces. The tyre's tread mixes are not as resistant to abrasion

as those used on tyres of types T and H, developed for lower speeds.

For this reason, the durability of high speed tyres in similar utilization conditions is substantially lower.

2.1.4 Factors that influence tyre durability

The following factors have different impacts as regards tyre durability.

Driving style:

- Speed ⇒ page 7
- Brakes ⇒ page 7
- Acceleration ⇒ page 8
- Displacement in a curve ⇒ page 8

More information is available on factors related to driving styles ⇒ page 7

Maintenance:

- Air pressure in tyres ⇒ page 8

More information is available on factors related to maintenance ⇒ page 8

Ambient conditions:

- Floor lining
- External temperature/Climate

Vehicle:

- Weight
- Values of convergence angles and camber

Tyre use:

- Speed limits
- Dry or wet

2.1.5 Driving style:

I. Motion at constant speed without slowing down or picking up speed

Example:

Speed in km/h	Skidding	Abrasion wear
100	1	1
180	3	9

II. Brakes (driving style)

Braking causes the greatest abrasion wear.

Example: Braking starting at a speed of 50 km/h

Braking course (m)	Deceleration (m/s^2) [2]	Skidding	Abrasion wear
Vehicle in motion until stop		0	0
100	0.1 x g	4	1
50	0.2 x g	8	4
12.5	0.4 x g [3]	32	2000 - 3000

2) g gravity acceleration: 9.81 m/s^2

3) The delay of 0.4 x g corresponds to a hard braking

III. Acceleration (driving style)

The skidding that occurs with a smooth starting is approximately the same that occurs at a constant speed of approximately 100 km/h. 100 km/h

Example:

	Skidding	Abrasion wear
Smooth starting	1 - 2	1
Normal starting	7 - 8	5
Starting with wheels skidding	20 and above	100 - 200

IV. Displacement in curve (driving style)

Also in curves, a "sporty" driving style and taking the curves at a higher speed can be noted from the higher wear profile.

In practice, this means that doubling the speed in a curve will result in a 16 times higher abrasion wear. This would be the "high-speed supplement" disbursed for faster travel.

Example: taking a curve with a 150 m radius

Speed in km/h	Transverse acceleration (m/s^2)	Abrasion wear
50	1 = 0.13 x g	1
80	2,5 = 0.33 x g	6.5
100	4 = 0.53 x g	16

4) g = gravity acceleration: 9.81 m/s^2

2.1.6 Tyre maintenance

Air pressure in the tyre

Note

Tire pressure must be checked in the label located on the fuel tank compartment lid. Or, in case of Kombi, the label located on column "B" of the driver side must be checked.

The weight of the vehicle causes the tyre's contact surface to flatten. During driving, the tyre suffers a forced deformation all around the tread and mesh. In case of low air pressure, the forced deformation is greater, resulting in greater heating and higher road resistance. This causes greater wear and a higher safety risk

Example: recommended air pressure, depending on load with empty tyres

Air pressure (bar)	Air pressure (%)	Kilometres travelled (%)
2.3	100	100
1.9	80	85
1.4	60	60

Air pressure (bar)	Air pressure (%)	Kilometres travelled (%)
1.0	40	25

Excessive air pressure would cause greater wear in the centre and worsen driving comfort. We recommend following the air pressure indicated by the manufacturer.

Note

- *The charts presented are not applicable to all situations and must show only the wear behaviour in the front and real axles and in vehicles with front-wheel and four-wheel drive.*
- *Depending on use conditions and on the running gear, the kilometres travelled can diverge substantially.*

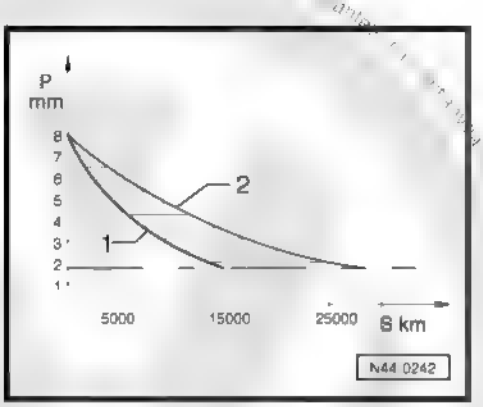


Diagram 1:

Track depth in kilometres travelled for vehicles with front-wheel drive and V tyres.

P - Track depth

S - Distance travelled

1 - Front axle

2 - Rear axle

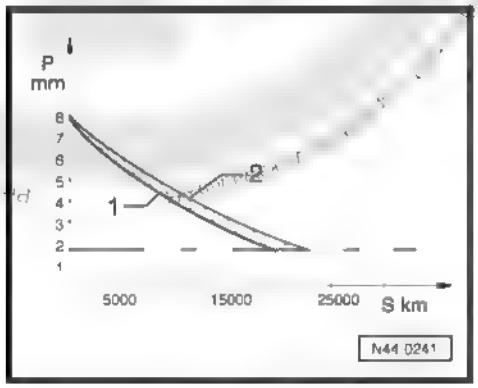


Diagram 2:

Track depth in kilometres travelled for vehicles with four-wheel drive and V tyres.

P - Track depth

S - Distance travelled

1 - Front axle

2 - Rear axle

As shown in graphs 1 and 2, the wear of a tyre with new track is, for a certain amount of kilometres travelled, greater than the wear of a tyre with a certain amount of use. After the first 5,000 km no conclusion can be drawn as to total duration, as the wear curve does not unfurl in a linear fashion.

In front-wheel drive vehicles, front tyres must transmit not only the steering and driving forces, but also most of the side and braking forces. Due to this demand, tyre wear in the front of front-wheel drive vehicles is much greater than in the rear tyres. A uniform wear of all the tyres may be obtained by rotating the front and rear tyres at regular intervals. Wheel replacement ⇒ page 42 .

2.1.7 Tyres with uniform wear

Demands put on tyres increase all the time.

The reason may be related to one of the following factors:

- heavier vehicle
- high speed
- greater vehicle safety

A greater effort by the tyre will entail greater wear.

The driving style has a decisive impact. For this reason, tyres with wear complaints and tread wear are replaced outside the warranty

The kilometres travelled by a tyre can be seen only with a remaining track depth of 2 mm; graphs ➢ page 9 .

2.1.8 Measuring track depth

Note

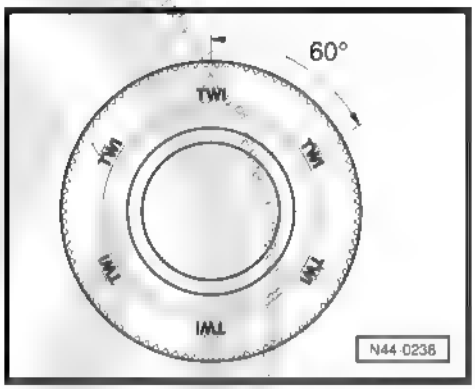
- *The main track splines are the measuring points to determine the track depth.*
- *Do not measure in TW (Tread Wear Indicator).*

The track depth must be measured in the main splines at the points of worse tyre wear. The positions of the TWI indicators are visible on the tire shoulder .

Instead of the "TWI" there may be a "Δ" or the manufacturer's "symbol".

The TWI projections are 1.6 mm high. This is the minimum surface track depth allowed by law.

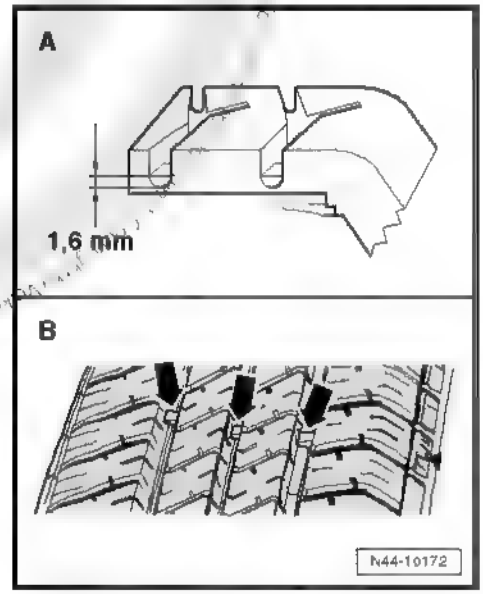
In other countries values may differ.



TWI indicators may not be included in the measurements. The measure obtained at the lowest point of the surface spline is determinant for the measurement value.

A - TWI indicators at the main surface splines.

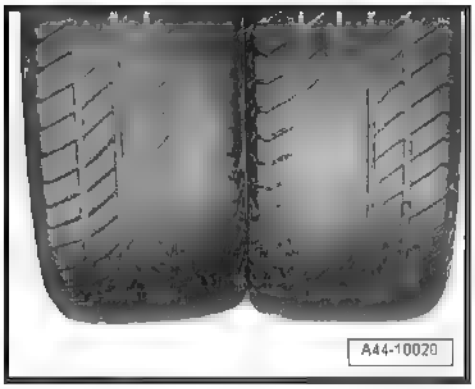
B - Main surface splines with TWI indicators -arrows-



2.1.9 Unilateral wear

The causes often reside in the vehicle's driving behaviour, but this may also result from an incorrect adjustment of the axles.

High unilateral wear



Unilateral wear is usually associated to abrasion in the tread ribs and to small hits, and it always occurs when the tyres run with an extreme roll angle, suffering as a consequence »abrasion wear« on the rolling lane

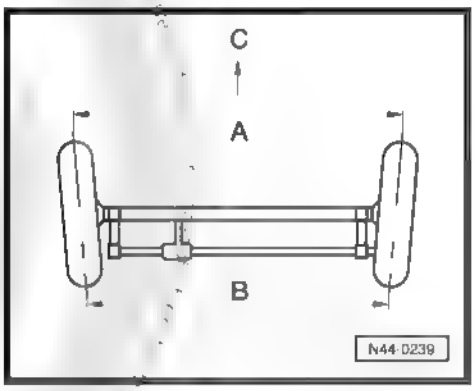
Fast travel in curvy stretches causes greater wear especially on the tyre's outer shoulder.

A rounded tyre outer shoulder, together with a pronounced wear of the tyre surface outer blocks, indicate that curves were taken at high speed. This wear situation is a consequence of driving style.

To optimize the behaviour of the moving vehicle, the values of the convergence angles and of the camber must be adjusted. If the tyres roll in conditions other than those indicated, there unilateral, greater wear.

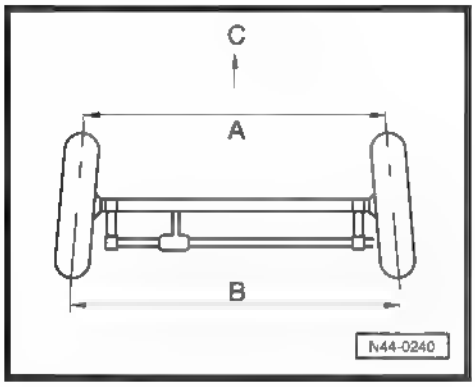
Particularly if the values of convergence angles and the camber are incorrect, the unilateral wear may be greater and the risk of diagonal abrasion may also increase.

Divergence or negative convergence



The distance between the wheels is greater at the front -A- than the distance -B- behind (-C- direction of travel).

Positive convergence



The distance between the wheels is lower at the front -A- in relation to distance -B- behind (-C- direction of travel).

To avoid unilateral tyre wear, observe that the position of the wheels remains within tolerance values indicated by the vehicle's manufacturer The most frequent wheel alignment deviation is due to external causes For example, hitting the wheel on the curb extremely hard during a parking manoeuvre.

While measuring the axle geometry, it may be determined whether the position of the wheel is within the tolerance values indicated or it may be necessary to carry out a correction.

Running gear alterations

If "lowering kits" and/or light alloy wheels not recommended by Volkswagen are used, the position of the wheels may diverge from the position indicated by the factory.

Even if the adjustment of the axle geometry appears to be correct when measured on the stationary vehicle, altering the height and position of the wheels with the vehicle in motion may modify the suspension's moving patterns.

Irregular wear will be the following consequence:

Inadequate use of running gear levelling with pneumatic suspension.

Using Off-road - Level adjustment is only recommended for all terrain driving. Permanently using Off-road - Level adjustment in normal driving conditions on (paved) roads may cause great tyre wear, because the height change modifies the position of the wheels in relation to the floor level.

To prevent unilateral tyre damage, on one side, the correct axle geometry adjustment must be ensured, while on the other side the vehicle must be used appropriately.

Good maintenance of vehicle and tyres contributes to prevent wear. The following indications must be observed for that purpose:

Note

Tire pressure must be checked in the label located on the fuel tank compartment lid. Or, in case of Kombi, the label located on column "B" of the driver side must be checked.

- The minimal tyre calibration pressure must be observed.
- Depending on driving style, different wear in front and rear axles may not be avoidable To counter this effect, the wheels may be rotated regularly. It is also useful to replace the summer tyres with winter tyres, and vice versa. This replacement has as a positive result an even wear on all tyres, making the assembly of a complete set of new tyres possible This avoids the use of tyres with different tread designs on both axles, and the results may be negative on behaviour of the vehicle in motion

- The wear in shape of saw consists in a normal wear especially in the very calm driving mode ➢ page 16 . This fact can cause a higher rolling noise (in the tread), but it usually owners again, as the reduction of depth grooves occurs. If the existence of a wear in the shape of saw is still incipient or it is still being built-up, the wheel's rotation on the axles is generally enough to resist to this effect. In case of unusual wear in shape of saw, the wheels shall be rotated in accordance ➢ page 16 , so as to change its tread direction.
- Some designs on the tyre tread suggest visually an anticipated wear when the ribs on the winter tyres or the incisions on the surface got worn, remaining only the compact blocks without empty areas, which give an idea of wear on the tyre. In this case, it is required to measure the remaining depth of the tyre tread remaining portion in each tyre's groove. If this depth is higher than the minimum depth required by law (1.6 mm; it is recommended in Germany the use of winter tyres with a remaining depth of 4 mm, and only under weather conditions typical of summer [law imposition in Austria], the tyre can continue to be used without reservation.

2.1.10 Wear on the outer shoulder

Improper use of running gear levelling adjustment with pneumatic suspension

Using Off-road - Level adjustment is only recommended for all terrain driving. Permanently using Off-road - Level adjustment in normal driving conditions on (paved) roads may cause great tyre wear, because the height change modifies the position of the wheels in relation to the floor level.

To prevent unilateral tyre damage, on one side, the correct axle geometry adjustment must be ensured, while on the other side the vehicle must be used appropriately.

Good maintenance of vehicle and tyres contributes to prevent wear. For this purpose, the following individual indications must be observed:

Note

Tire pressure must be checked in the label located on the fuel tank compartment lid. Or, in case of Kombi, the label located on column "B" of the driver side must be checked.

- The minimal tyre calibration pressure must be observed.
- Depending on driving style, different wear in front and rear axles may not be avoidable. To counter this effect, the wheels may be rotated regularly. It is also useful to replace the summer tyres with winter tyres, and vice versa. This replacement has as a positive secondary result an even wear on all tyres, making the assembly of a complete set of new tyres possible. This avoids the use of tyres with different tread designs on both axles, and the results may be negative on behaviour of the vehicle in motion.
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2.1.11 Wear on the centre portion of the tyre

This wear condition can be seen on the driving wheels of powerful vehicles that ride long distances at high speeds.

At high speeds, and due to centrifugal force, the diameter of wheels increases more at the centre portion of tyre's tread than on the tyre's shoulders. Consequently the propulsion force is transmitted up from the centre area of tyre tread on the asphalt surface. This is reflected on the wear condition.

These symptoms are noticeable especially on wide tyres.

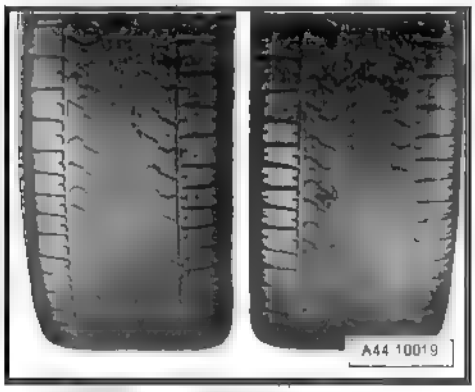
The reduction of air pressure on the tyres does not change this wear condition.

> **WARNING**
>
> *The reduction of tyre inflation pressure below the indicated values is not allowed, for safety reason.*

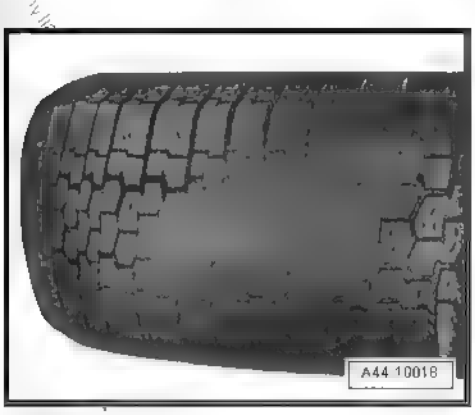
The wear condition due to abrasion remains even if the tyre rotation is made from front axle to rear axle.

Higher wear on the tyre tread

The higher wear on the centre portion of the tyre tread is linked to the effort's request resulting from centrifugal force of tyre and transmission of propulsion forces.



2.1.12 Diagonal abrasion



The diagonal abrasion on the tyres

The diagonal abrasion occurs at an angle of about 45° concerning the perimeter direction.

In the most of cases they happen only once, but several abrasion conditions can arise on the tyre perimeter.

The wear due to abrasion happens almost exclusively on the tyre not impelled, especially on the rear left tyre. There are models of vehicles where the wear due to abrasion arises continuously and there are models where this type of wear does not cause any problem. The effect is increased due to high toe-in values. The toe-in values located close to lower tolerance limit of adjustment values indicated improve the wear condition.

The connection point of tyre components is frequently on the most accentuated abrasion zone.

The wheels with toe-in roll including when the vehicle is being driven straight ahead at an oblique rolling angle. This fact causes a diagonal stress on the asphalt/tyre contact zone.

To resist to such wear conditions, the toe-in values of both rear wheels shall be similar and the air pressure values shall be kept within the indicated values.

When abrasion conditions are detected, the wheels shall be assembled in the drive shaft if the abrasion wear is at the beginning. An accentuated wear due to abrasion is not serviceable.

Adjustment errors

In case of claim due to "diagonal abrasion", check the toe-in adjustment. If the toe-in values are correct, the cause of diagonal abrasion is probably on the tyre.

The tyres with diagonal abrasion due to wrong adjustment of axle geometry on the wheels are not covered by warranty.

2.2 Rolling noises coming from the tyres

2.2.1 General notes about rolling noises

The rolling noises perceptible by human ears are the result of vibrations coming from a sound source, and they reach our ears through the air.

In this case the noises engage our attraction; they are caused due to certain features and effects while the tyres are rolling.

The reason for noise occurrence depends essentially on the combination tyre/rolling lane.

The structure of the surface and the running lane material influence the rolling noise very much too. The noise level caused on a wet running lane is, for example, substantially higher than that on a dry running lane.

The type of profile of the tyre tread has a great influence on the noise occurrence. The tyres with 90° angle-grooves cause more noise than those tyres with oblique angle drawing.

The tyre tread blocks of small tyres are unstable. The air is excited due to its strong deformation during the tyre rolling There are vibrations caused by air that produce noises

The wider tyres cause more noises. They need a higher quantity of grooves for flowing the water During driving, these grooves on the tyre tread displace the air and it vibrates

Other effects that influence the noise occurrence:

- The "vibration of tyres" is the main cause of rolling noises These noises are caused by excitement of air columns in the tyre's tread grooves.
- "Air pumping" is the compression and the expansion of the air that builds up in the connection of tyre's bearing surface with the running lane, due to deformation of tyre's tread blocks

Argumentation aid in case of rolling noises

The noise occurrence is caused essentially due to tyres and the running lane.

The influence factors of running lane are roughness, the structure and the material.

The factors that influence the tyres are the wheel and the tyre width, among others. A wider tyre, due to its bearing surface, induces to noise occurrence, because it repels more air and because there is more "mass" to vibrate than in a smaller tyre.

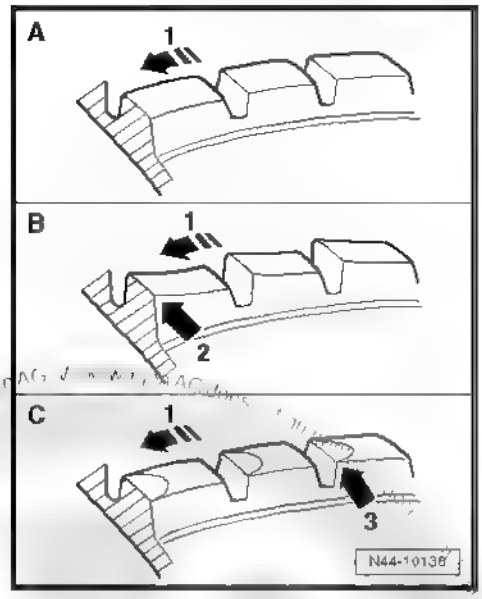
Likewise, a wider wheel originates a wider bearing surface. The effects of the noise occurrence are basically similar to those of a wider tyre. Moreover, the attenuation features of the tyres are negatively influenced by wider wheels under given circumstances.

The rolling noises are especially perceptible at the rear portion of those vehicles equipped with front engine, provided that the noises coming from the engine and from the wind are less audible at the rear portion of the passenger compartment.

2.2.2 Wear occurrence in the shape of saw

The wear in the shape of saw is a layered wear of every tyre tread block ⇒ page 17 , causing an increase of the rolling noise. The saw teeth appears due to uneven deformation of the tyre tread blocks on its bearing surface. At the non-driving wheels, the wear in the shape of saw happens in a more accentuated way than on the driving wheels.

On new tyres there is a more accentuated trend to the build-up of saw teeth, because the tyre tread blocks have a higher elasticity The reduction of the tyre's tread groove depth increases the rigidity of the blocks on the floor, reducing the trend for wear occurrence in the shape of saw



Aspect of saw tooth

A - Blocks of the tread on a new tyre, the blocks of the tyre tread have in the drive direction perspective, -arrow 1- the same height forwards and backwards.

B - Wear occurrence in the shape of saw, the blocks of the tyre tread in the drive direction perspective are -arrow 1- higher at the front portion than at the rear portion -arrow 2-.

C - The blocks on the tyre tread blocks present in the running direction perspective, -arrow 1- a higher wear on the front portion of the "saw tooth" -arrow 3-.

If there is an accentuated occurrence of wear in the shape of saw, it may lead to claims due to noises.

Cases where the occurrence of wear in the shape of saw is accentuated:

- toe-in values too high
- wrong tyre pressure
- tyre tread profile rough and open
- tyres assembled in an axle deprived of propulsion.
- displacement in winding routes under extreme conditions

Tyres without indication of tread direction

When the saw teeth appear, the change of the tread direction of the tyre is required. If the wear occurrence in the shape of saw is accentuated, as well as the rolling noise, perform the tyre rotation on a crisscross pattern. This procedure leads to a reduction of saw teeth.

In those vehicles equipped with front traction, this effect is amplified, due to a higher wear existing on the front axle.

The rolling noise will be a little more intensive immediately after the tyre change, however, after approximately 500 ... 1000 km, the normal level of noise will be reached again.

Tyres with indication of tread direction

In case of a great quantity of saw teeth on the tyres of the rear axle - preferably on vehicles equipped with front traction - perform the change of the rear tyres to the front axle. If there are accentuated saw teeth on the outer edge of an axle, return both tyres to the wheel. Following, the left wheel shall be assembled at the right side and the right wheel at the left side.

2.2.3 Blockage points

The blockage points are the consequence of sudden braking when the wheels are blocked, when at the tyre/running lane matching surface there is rubber wear due to friction

During the skidding of the tyres on the running lane there is heat build-up due to friction and it reduces the resistance to wear of tyre tread material.

Even a mix of the tyre tread resistant to wear due to friction does not exclude blockage points, as it happens under extreme conditions of sudden breaking

The braking systems monitored by the ABS system do not get to hinder the blockage, including a short duration one, and exclude the corresponding flattening of reduced dimensions

The quantity of wear depends essentially on the speed of the vehicle, on the asphalt coverage and on the load supported by the wheel For a better comprehension, examples numerically quantified are indicated as follows

If a vehicle is braked until the immobilization with the front wheels blocked on dry surface, the wear due to friction on the bearing surface of the tyre with the dimensions of a mail stamp is of approximately

- at 57 km/h = 23.8 m braking travel until 2.0 mm
- at 75 km/h = 41.8 m braking travel until 3.3 mm
- at 92 km/h = 71.6 m braking travel until 4.8 mm

Blockage points at the tyre tread

Tyres with damages of this nature are useless and have to be replaced.

2.3 Drive instability due to rim/tyre

2.3.1 Causes of drive instability

The causes of drive instability have several sources. The drive instability can be originated in the wear of the tyres, amount other causes. The wear of the tyres resulting from driving the vehicle is not processed in an even way on the whole tyre tread. This way, some small unbalances occur and they affect the rolling of the wheel balanced before accurately.

These small unbalances are not perceptible at the steering wheel, but they exist as a matter of fact. They accelerate the wear of the tyre and reduce its useful life as a result.

Recommendation

In order to get during the whole useful life of a tyre.

- safety
- rolling stability and
- even wear

We recommend the balancing of the rim/tyre assembly at least twice during the useful life of the tyres

2.3.2 Wheel balancing.

Before beginning the balancing, it is required to meet the following conditions:

- The tyre's pressure has to be right.
- The tyre tread cannot be worn only in one of the sides, the minimum depth shall be 4 mm.
- The tyre cannot present damages, as cuts, incisions, strange material, etc.
- The suspension, the steering wheel, the drag links and the shock absorbers have to be perfectly operating.
- A test drive has to be performed ⇒ page 19 .

2.3.3 Perform a test drive before performing the wheel balancing.

If the vehicle goes to the repair shop with a claim about "drive instability ", a test drive shall be performed before performing the wheel balancing.

- ♦ This way it is possible to obtain information about the type of drive instability.
- ♦ It is possible to notice the speed range where the instability happens.

– Put the vehicle on the lift after performing the running test.

– Before removing the wheels, the installation point should be marked and the identification has to be done according to the table below:

Location of the tyre	Identify with ...
left front tyre	FL
front right tyre	FR
rear left tyre	RL
right rear tyre	RR

– Remove the wheels from the vehicle.

– Perform the wheel balancing.

2.3.4 Wheel balancing with the static balancing machine.

Attach the wheel to the balancing machine.

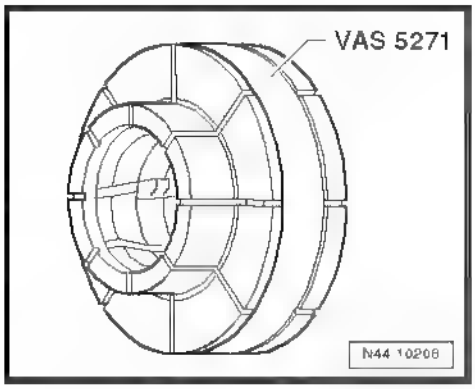
Note

As in any other repair, taking care of the cleanness when balancing the wheel is an indispensable factor. Only this way it is possible to get a perfect result!

Dirt and rust on the thrust surface area and centre portion of the wheel impair the result

– Clean the thrust surface, the centre portion of the wheel and the wheel disc before attaching it to the balancing machine!

– Attach the wheel to the balancing machine.



Note

- *For attaching the wheel, use, for example, the Centering system for wheel balancing machines - VAS 5271- .*
- *This way, it is assured a central positioning of the wheel at 100% and a very good attachment*
- *It is not possible to position the wheel at 100% to the balancing machine with conical fixtures.*
- *A deviation of 0.1 mm outer of the centre causes a misbalance at the wheel/tyre of 10 grams.*

Evolution of wheel balancing operation.

- Turn the wheel at the balancing machine.
- Check the course of the distinctive curves on the side walls of the tyre next to the rim flap.
- Check the design of the tyre tread while the wheel is rolling.

Note

If there is one-sided wear, due to sudden braking or strong wear due to abrasion, it is not possible to reach the drive stability through the wheel balancing. In these cases, the tyre must be replaced.

- Check the concentricity of the wheel. If the wheel rolls eccentrically, despite of inexistance of deformation, the cause can be a radial deviation or an axial deviation.
- Inspect the wheel for existence of radial and axial deviations ⇒ page 21 .
- If the axial and radial deviation remain within the tolerance values allowed, perform the balancing of the rim and of the tyre.

Note

- *Do not use more than 60 grams of weight for each wheel.*
- *If the use of more weight is required, it is possible, occasionally, to obtain better drive stability through the modification of the positioning of the tyre in relation to the rim in 1/4 of turn sequentially, until getting the best result. Correction of deviations in the wheel balancing through the positioning in relation to the rim. ⇒ page 23*
- *The indicator on the balancing machine shall show 0 gram.*
- *As an alternative to the deviation in the dynamic balancing of the wheel, the Wheel balancer - VAS 6202- can be used.*

- Screw the wheel to the vehicle.
- First, screw the lowest stud of the wheel, not tightening it much, with approximately 30 Nm.
- Now, tighten the remaining screws for the wheel similarly with approximately 30 Nm and on a crisscross pattern. This way, it is possible the centering of the wheel to the corresponding hub.
- Put the vehicle on the wheels

- Now, tighten the studs of the wheel on a crisscross pattern with a torque wrench with the tightening torque specified for the vehicle in question

Perform a test drive.

- After balancing the wheel, perform a test drive.

If during the test drive the continuation of the drive instability is perceptible, it may happen due to tolerances existing in the centering of the wheel

2.3.5 Radial and axial deviation of concentricity of rim/tyre assembly

The radial and axial deviations arise due to inexact concentricity of the rim and the tyre.

The concentricity to 100% is not feasible due to technical reasons.

This way, the manufacturers allows for these components tolerance values exactly defined.

When the wheel and the tyre are assembled in an unfavourable position, this will not be considered a reason to exceed the maximum values of tolerance allowed to the rim/tyre assembly.

The maximum allowable tolerance values on the table may be referred to the assembled rim/tyre assembly.

Tolerance values to the radial and axial deviations of concentricity of rim/tyre assembly.

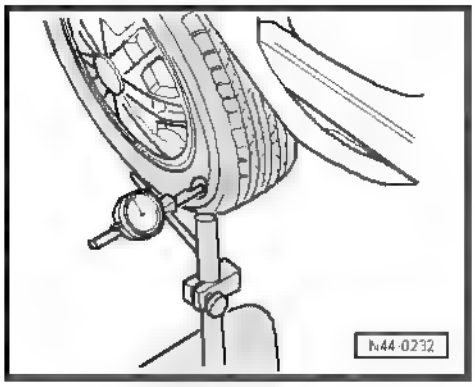
Rim/tyre assembly.	Radial deviation of concentricity (mm)	Axial deviation of concentricity (mm)
Automobile	0.9	(1.3 in the nomenclature zone)

2.3.6 Inspect the radial and axial deviations of the rim/tyre assembly with the Tyre gauge - V.A.G 1435-

Inspect the axial deviation.

- Connect the Tyre gauge - V.A.G 1435- with approximately 2 mm of pre-tension.

- Lean the Tyre gauge - V.A.G 1435- against the side surface of the tyre.
- Turn the wheel slowly.
- Record the maximum and minimum amplitude of the needle.



Note

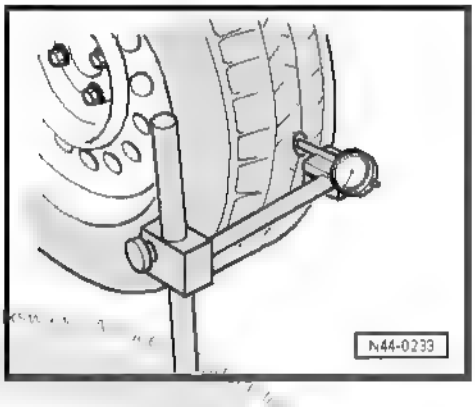
If the difference is higher than 1.3 mm, the axial deviation of concentricity will be too high.

In this case, the reduction of the axial deviation through the positioning of the tyre in relation to the wheel is possible ⇒ page 23 .

It is unnecessary to take into account the needle deviations of the Tyre gauge - V.A.G 1435- due to small irregularities of the rubber.

Inspect the radial deviation.

- Connect the Tyre gauge - V.A.G 1435- with approximately 2 mm of pre-tension.
- Lean the Tyre gauge - V.A.G 1435- against the tyre tread.
- Turn the wheel slowly.
- Record the maximum and minimum amplitude of the needle.



Note

If the difference is higher than 1 mm, the radial deviation of concentricity will be too high.

In this case, the reduction of the vertical deviation through the positioning of the tyre in relation to the wheel is possible ⇒ page 23 .

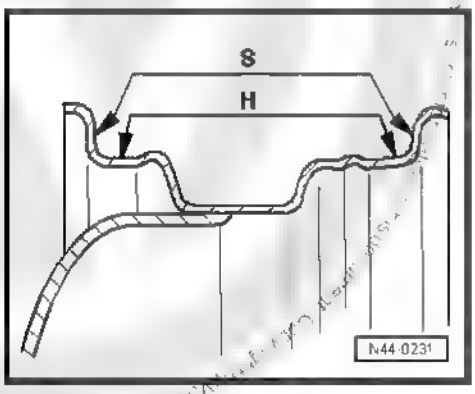
2.3.7 Inspect the radial and axial deviations of rim concentricity

- Connect the rim to the Wheel balancer - VAS 6202- .
- Use the Wheel balancing machine centering system - VAS 5271- .
- Connect the Tyre gauge - V.A.G 1435- with approximately 2 mm of pre-tension.
- Turn the rim slowly.
- Record the maximum and minimum amplitude of the needle.

S - Axial deviation of rim concentricity

H - Axial deviation of rim concentricity

- Compare the value settled with the nominal values on the table ⇒ page 23 .



Note

It is unnecessary to take into account the needle deviations of the Tyre gauge - V.A.G 1435- due to small irregularities

Nominal values to the radial and axial deviations of wheel concentricity

Rim		Radial deviation of concentricity (mm)	Axial deviation of concentricity (mm)
Automobile	Steel rim	0.5	0.5
	Light metal rim	0.5	0.8

Note

If the value measured is higher than the nominal value, it will not be possible to reach an acceptable drive stability.

2.3.8 Positioning of the tyre in relation to the rim

Miscellaneous

When the radial or axial deviation of the rim and of the tyre match, the drive instability of the wheel with the tyre rises.

The concentricity to 100% is not feasible due to technical reasons ⇒ page 21 .

Before starting the positioning of the tyre in relation to the wheel, perform a warm-up of the tyres through displacement of the vehicle. This way occasional deformations due to stoppage are eliminated ⇒ page 24 .

Sequence of operations to perform the positioning of the tyre in relation to the wheel

- Deflate the tyre.
- Loosen the tyre beads from the wheel flap.
- Pass the tyre beads around the wheel with Tyre assembly paste . Refer to the ⇒ Chemicals Manual .
- Displace the tyre 180° in relation to the rim.
- Inflate the tyre until approximately 4 bar.
- Attach the rim with the tyre using the balancing machine.
- Inspect the radial and axial deviations of rim concentricity.

Note

- *If the nominal value of radial and axial deviations are not exceeded, balance the wheel to 0 gram. The nominal values may be referred in ⇒ page 21 .*
- *It is required to displace the tyre again if the radial and/or axial deviations are out of nominal values.*

- Remove the air from the tyre and loosen the tyre from the rim flaps.
- Displace the tyre 90° in relation to the rim (1/4 of turn).
- Inflate the tyre again to 4 bar-pressure and check the concentricity.

Note

- *If the nominal value of radial and axial deviations are not exceeded, balance the wheel to 0 gram.*
- *It is required to displace the tyre again if the radial and/or axial deviations are out of nominal values.*

– Loosen the tyre from the rim flaps again, according to description above.

– Displace the tyre 180° in relation to the rim (1/2 of turn).

If the radial and/or axial deviation is out of nominal values yet, check the rim radial and axial deviations ⇒ page 22 .

It the vertical and horizontal deviations at the rim is within the nominal values, the tyre has a vertical or horizontal deviation excessively high. In this case, replace the tyre.

Note

- *Due to tyre assembly, there is assembly paste between the tyre and the wheel flaps.*
- *For this reason, avoid sudden acceleration and braking during the first 100 or 200 km of the travel. Otherwise, the tyres may displace from the wheel and the operation would be all in vain!*

2.3.9 Tyre deformation

What is a tyre deformation due to stoppage?

To define the deformation phenomenon, synonyms as depression and flattening are similarly used.

The deformations cause drive instability too, such as a wheel incorrectly balanced. The important is the identification of a deformation on the tyre tread.

The deformations cannot be eliminated through balancing and can have different causes. It is possible the elimination of deformations without the use of special tools. We take as principle that it is not a deformation caused by a sudden braking ⇒ page 17 .

Note

The deformations caused by braking are not serviceable damages on the tyres! The tyres with this type of damages have to be replaced.

Causes of deformations

- The vehicle is stopped for several weeks in the same place, without motion.
- The tyres have a pressure too low.
- After painting, the vehicle was put in a drying chamber of a body and painting shop.
- The vehicle was parked for a long time with warm tyres in a cold garage or in a similar place. In this case, a deformation can arise from one day to another.

Eliminate deformations

- The deformations cannot be eliminated from the tyres with the means of a repair shop.
- The only way to eliminate the flattening is through tyre warm-up during the motion of the vehicle.

> **WARNING**
>
> - *Do not expose yourself or other persons to danger during the test drive*
> - *Respect the traffic laws, and the imposed speed limits.*

– Immediately lift the vehicle after the test drive.

– Remove the wheels from the vehicle.

– Balance the wheels at the stationary balancing machine ⇒ page 19 .

2.4 The vehicle deviates to one side

2.4.1 Miscellaneous

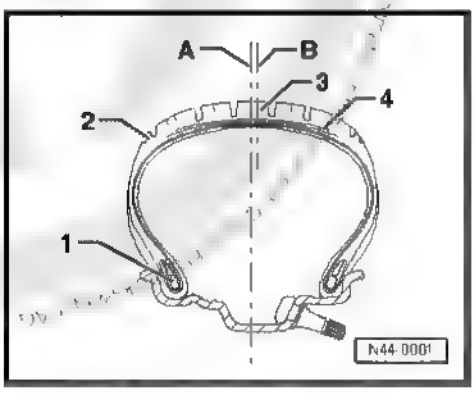
Determine, through the test drive, if the vehicle pulls to the side and, in affirmative case, to what side. If the vehicle pulls to one side ⇒ page 26 .

If the wheel alignment was done, attach the corresponding report to the tyre claim.

Due to manufacturer tolerance values it is possible to check the conicity of the frame. Thus, while the tyre is rolling, there is a side force that acts directly on the suspension and can lead to a self-direction behaviour of the vehicle. Through selective changes of wheels, it is possible to compensate this self-direction behaviour.

2.4.2 Conicity

The conicity is caused by a slight displacement (some tenths of a millimetre) of the tyre tread and/or steel wire mesh in relation to tyre's geometric centre. The conicity is not detectable through the eyes and can not be measured with the repair shop's means.



Tyre components

1 - Tyre bead

2 - Tyre shoulder

3 - Tyre tread

4 - Interlaced steel wire mesh

A - Tyre geometric centre

B - Real position of the mesh. The mesh may be misaligned inwards or outwards.

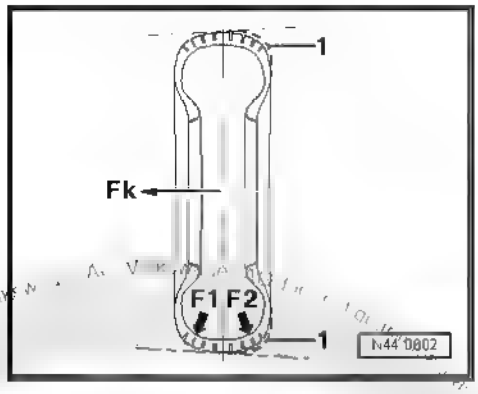
Representation with some exaggeration for a better visualization

1 - Misalignment of the tyre mesh/tyre tread

F1 - Unequal supporting forces of the wheel

F2 - Unequal supporting forces of the wheel

Fk - Conicity force



Due to misalignment, a variable rigidity on the outer and inner tyre shoulder is verified, and it leads to different supporting forces of the wheel. Due to this, the mesh and the tyre tread do not exert the same force (F1, F2) on the running lane There is a cone. The resulting force (conicity force Fk) may, depending on the speed, become so strong that the vehicle pulls to one side.

If the force (Fk) in a axle wheel is 50 Newton, for example, in the other wheel it is also 50 Newton, and if these forces act in the same direction, they will have a cumulative effect. Turning the tyre in relation to the wheel, it is possible to compensate the deviation to the side, because the forces are opposite in their action.

Once it is not possible to visualize on the tyre the direction that the conicity force acts, only with a test drive and a selective wheel or tyre change it is possible to verify which tyre is causing the deviation.

The tyre is composed by several components and materials that, at the end of a very demanding manufacturing process, they are vulcanized in a piece. Several manufacturing tolerances result from this process, and they may be noticed through more or less strong side forces (side conicity forces). These forces can happen on new tyres too.

The vehicle pulls to one side in the front axle.

The causes of this side deviation may be in the running gear. Nevertheless, according to experience, in more than 90% of the claims, the cause for vehicle's pulling to one side is the tyres.

The vehicle pulls to one side under normal driving.

Driving in a straight and flat surface, at constant velocity or under moderate acceleration, the vehicle shows the trend of pulling to one of the sides. A force at the steering wheel is felt.

The vehicle pulls to one side under strong acceleration.

In those vehicles equipped with front traction, if the vehicle pulls to one of the sides under strong acceleration, it is concerned in part with its own conception. The different friction ratios between the left wheel and the right wheel or the occasional irregularities on the pavement (deep potholes) and consequently the oscillating adherence to the floor influence the driving features very much. It is not a claim in the extent of warranty.

2.4.3 Solution when the vehicle deviates to one side

Inspection conditions before and during the test drive

- Inspect all suspension components on the front axle and on the rear axle for damages.
- Check the inflation of the tyres and correct it if required
- Check the tyres for visible damages from the outer portion of the vehicle. Perforations, cuts and crushing on the side wall, deformations caused by braking and/or damages on the tyre tread.

- Ask to the client if the tyre was perforated by a nail or something similar and if it was repaired by a tyre specialized repair shop. Occasionally replace these tyres
- Check the tyres for regular wear and depth of the groove.
- The tyres are of the same type and brand and/or have the same type of groove?
- In case of tyres without tread direction, assure that all tyre DOT symbols are faced outward. Possibly it was already done, previously, a tyre or wheel replacement.
- Is it a tyre's brand approved by manufacturer to be used as genuine component?
- In order to perform the test drive, use a flat and straight surface, not inclined to one side and without grooves.
- Perform a test drive with the client, taking into account the conditions mentioned above. The client shall submit a claim.

Note

There must not be any side wind during the test drive.

If the claim is justifiable, we recommend the change of the wheels/ tyres according to the content of the following pages.

Before beginning the operations, it is very important to read the following indications, otherwise the efforts performed may be useless!

Note

- *Mark the tyres/wheels before the first replacement, for example, FL, FR, RL, RR.*
- *After the change of the wheels, of after the modification of the tyre position on the wheel, take special care to the behaviour of the vehicle during the test drive. Note the replaced components and how they were replaced.*
- *It shall be checked the intensity or the occasional change of side deviation of the vehicle.*
- *For that, it is strictly required that the driving tests are always performed by the same person and on the same surface. The optimal scenario is to perform the test drive in both directions of the "test route" chosen.*
- *When replacing a tyre by a new one, it is not assured that the vehicle will not pull to one of the sides anymore. For this reason, it is recommended that first the selective change of the wheels is performed, as described on the following pages.*
- *In case of a great depth difference on the tyre grooves of the front axle and rear axle, the tyres with higher groove depth shall be assembled always at the same axle*

2.4.4 Selective change of wheels for tyres without tread direction

Determine, through the test drive, if the vehicle pulls to the side and to which side

<table>
<tr><td colspan="4">If the vehicle pulls to one side, change the position of the front wheels.</td></tr>
<tr><td colspan="4">↓</td></tr>
<tr><td colspan="4">Perform a test drive</td></tr>
<tr><td colspan="4">The vehicle drives straight ahead - THE END</td></tr>
<tr><td colspan="2">The vehicle pulls to the opposite side.</td><td colspan="2">The vehicle pulls to the same side</td></tr>
<tr><td colspan="2">↓</td><td colspan="2">↓</td></tr>
<tr><td colspan="2">Turn a tyre at the wheel front axle (change the turning direction).</td><td colspan="2">Install the front wheels at the rear axle of the vehicle.</td></tr>
<tr><td colspan="2">↓</td><td colspan="2">↓</td></tr>
<tr><td colspan="2">Perform a test drive</td><td colspan="2">Perform a test drive</td></tr>
<tr><td colspan="2">The vehicle drives straight ahead - THE END</td><td colspan="2">The vehicle drives straight ahead - THE END</td></tr>
<tr><td colspan="2">The vehicle does not drive straight ahead</td><td colspan="2">The vehicle does not drive straight ahead</td></tr>
<tr><td colspan="2">↓</td><td colspan="2">↓</td></tr>
<tr><td colspan="2">Change the front and the rear wheels among themselves.</td><td>The vehicle pulls to the opposite side.</td><td>Without change</td></tr>
<tr><td colspan="2">↓</td><td>↓</td><td>↓</td></tr>
<tr><td colspan="2">Perform a test drive</td><td rowspan="5">Turn a tyre at the wheel front axle (change the turning direction)</td><td rowspan="5">Check the front and rear axle alignment and align, if required.

If the alignment is correct, inform the department responsible by the product.</td></tr>
<tr><td colspan="2">The vehicle drives straight ahead - THE END</td></tr>
<tr><td colspan="2">The vehicle does not drive straight ahead</td></tr>
<tr><td colspan="2">↓</td></tr>
<tr><td colspan="2">Change the front wheels among them.</td></tr>
<tr><td colspan="2">↓</td><td colspan="2">↓</td></tr>
<tr><td colspan="2">Perform a test drive</td><td colspan="2">Perform a test drive</td></tr>
<tr><td>The vehicle drives straight ahead - THE END</td><td>The vehicle does not drive straight ahead</td><td colspan="2">The vehicle drives straight ahead - THE END</td></tr>
<tr><td rowspan="3"></td><td>↓</td><td colspan="2">The vehicle does not drive straight ahead</td></tr>
<tr><td>Assemble new tyres at the front axle</td><td colspan="2">Assemble new tyres at the front axle</td></tr>
<tr><td>↓</td><td colspan="2">↓</td></tr>
</table>

	Perform a test drive	Perform a test drive	
	The vehicle drives straight ahead - THE END	The vehicle drives straight ahead - THE END	
	↓	↓	
The vehicle does not drive straight ahead, inform the department responsible by the product			

2.4.5 Selective change of wheels for tyres with tread direction

↓
Determine, through the test drive, if the vehicle pulls to the side and to which side
↓
If the vehicle pulls to one side, install the front wheels/tyres to the rear axle.
↓
Perform a test drive
The vehicle drives straight ahead - THE END
The vehicle does not drive straight ahead
↓
Replace a front axle tyre first.
↓
Perform a test drive
The vehicle drives straight ahead - THE END
The vehicle does not drive straight ahead
↓
Replace the second front axle tyre
↓
Perform a test drive
The vehicle drives straight ahead - THE END
The vehicle does not drive straight ahead
↓
Alight the front portion and the rear portion of the vehicle.
↓
Perform a test drive
The vehicle drives straight ahead - THE END
The vehicle does not drive straight ahead, inform the department responsible by the product

2.5 Damages on the tyres

2.5.1 General guidelines

The existence of damages on the tyres may have serious consequences.

The best hypothesis for an anticipated detection is the regular control performed by the driver

Tyres already damaged do not resist to driving conditions as high speed, long distances, sporty driving and similar ones

The damage in a tyre may have several factors:

- Driving with insufficient air pressure
- Failure when assembling the tyres
- Damage caused by crashes
- Aging
- Incorrect storage

WARNING

Always when there is the suspicion of a risk for the safety, the tyre must be changed.

2.5.2 Structure of a radial tyre

Transversal cut of a radial tyre

1 - Block of the tyre tread

2 - Grooves of the tyre tread

3 - Tyre tread

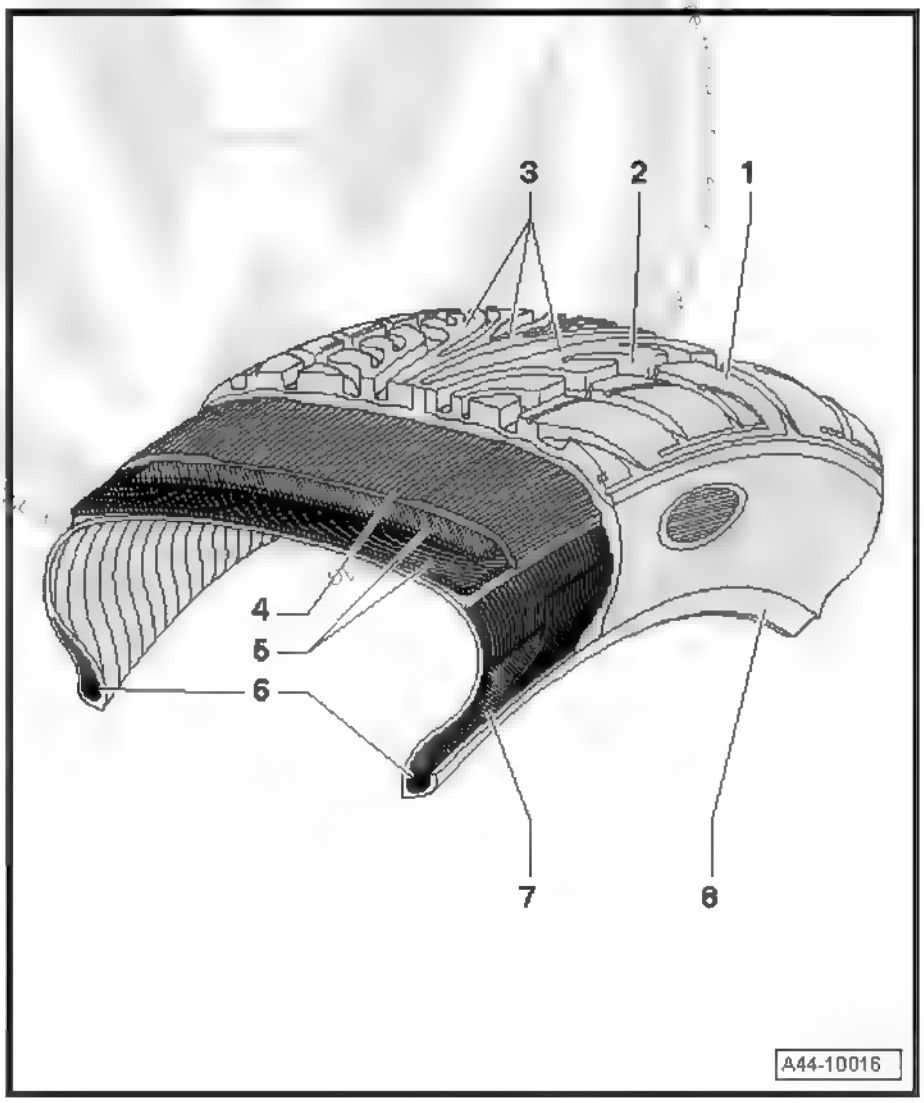
4 - Nylon stabilizer mesh

5 - Interlaced wire mesh
- are, in most cases, manufactured in steel

6 - The wires of the tyre bead
- are formed by steel wires covered by rubber through vulcanization process.
- It assures the stable seat of the tyre to the wheel

7 - Reinforcement of the tyre bead

8 - Wheel flap protector
- It is a protection against friction points in the wheels and in the tyres, for example, in case of contact with the sidewalk curb.
- The tyres with wheel protection are identified with the MFS abbreviation or identification



The nylon stabilizer mesh -4-, the mesh coat -5-, the tyre bead wires -6- and the bead reinforcements -7- form the case. The case is the "assembly structure" of the tyre

2.5.3 Damages caused by crashes

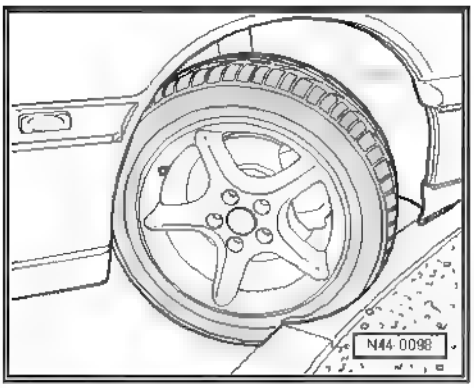
A "crushing (crease)" on the tyre rubber wall indicates that the case was damaged in the sub-frame of the tyre

One of the typical causes for these types of damages is, for example, when the vehicle climbs a sidewalk curb where there is an acute angle.

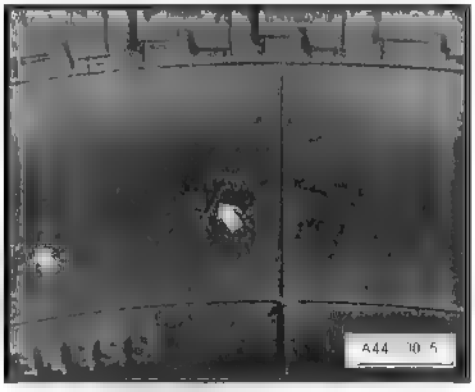
The case of the tyres "compressed" may be, this way, damaged.

The sub-frame of the tyre is stretched in such a way that causes the rupture of the individual fibres existing in the case.

The dimension of the damage depends on the impact speed, impact angle, air pressure of the tyres, weight of the axle and type of obstacle.



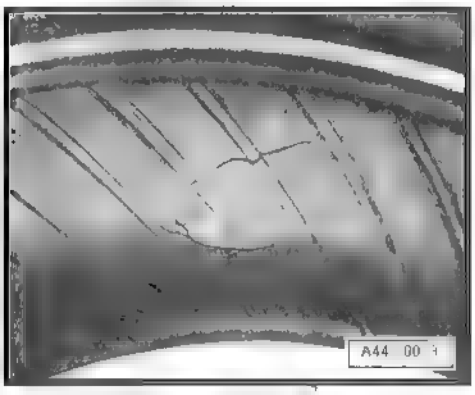
Vestiges of compression on the side wall of a tyre -arrows-.



Note

- *Avoid climbing the sidewalk curbs.*
- *If unavoidable, climb the sidewalk by keeping the straightest angle possible.*

Inner view of a tyre with broken case, due to strong impact. The case was smashed on the wheel rim and is broken on the contact zone.

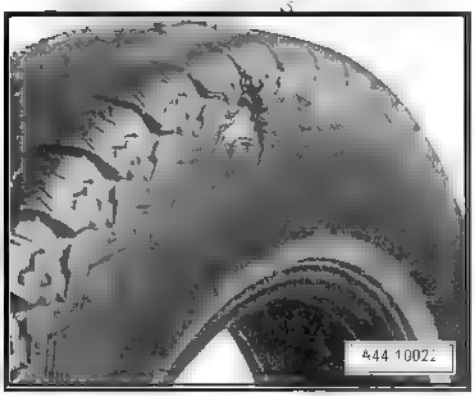


Damage in the inner portion of a tyre due to a crash (double rupture)

Double rupture -arrows-, due to compression when climbing. Usually not identifiable from the outer portion.

2.5.4 Damages due to cut.

Cut caused by pointed obstacle -arrow-



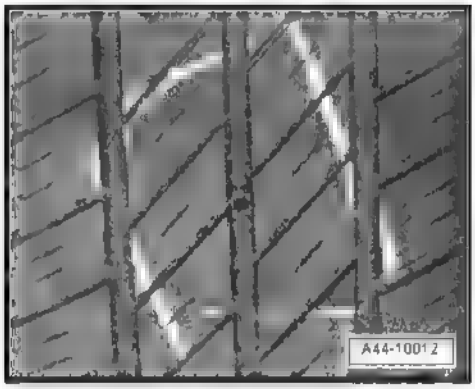
2.5.5 Damages caused by strange bodies

When driving over hard and pointed objects such as, for example, nails, bolts or similar objects, the tyre can be perforated

This always causes a damage to the tyre

Damage caused by a strange body thrust in

Sometimes, the strange body -mark- is driven so firmly on the tyre that even at high speeds it is not released In this case, it may play a plug role and seal the tyre relatively well The consequence consist in the slow loss of air, not immediately detected by the driver, but it may cause the tyre to become totally unusable



Note

The tyres with interlaced steel wire mesh, whose structure has been perforated by a strange body, cannot be repaired.

2.5.6 Loss of air from the tyres

With the claim "loss of air", the inspection of the tyres for strange bodies thrust in is mandatory.

Note

The tyres with interlaced steel wire mesh, whose structure has been perforated by a strange body, cannot be repaired.

There may be corrosion in the steel wires. This must lead to the separation of the rubber from the interlaced steel wire mesh.

On the whole, it is not possible to determine where the strange body was thrust in. This way, there may be immediate damages to the tyre, due to driving with little air pressure.

The damaged interlaced steel wire mesh lead, sooner or later, to the separation of the rubber from the steel mesh. This way, after a given driving period, the tyre can get completely useless, a long time after the inspection of the damage to the tyre.

The tyres damaged by strange bodies constitute damages not covered by the warranty.

2.5.7 Air pressure

Note

Tire pressure must be checked in the label located on the fuel tank compartment lid. Or, in case of Kombi, the label located on column "B" of the driver side must be checked.

The air pressure shall be controlled at regular intervals We recommend a 7 day-interval between every air pressure inspection. A correct air pressure is especially important during long trips or if the vehicle is driven with load A sporty driving also requires a correct air pressure or even a slightly raised air pressure.

Slow reduction of air pressure

The slow reduction of the inner pressure of the tyres is a treacherous process, because not even the most skilled drivers can detect.

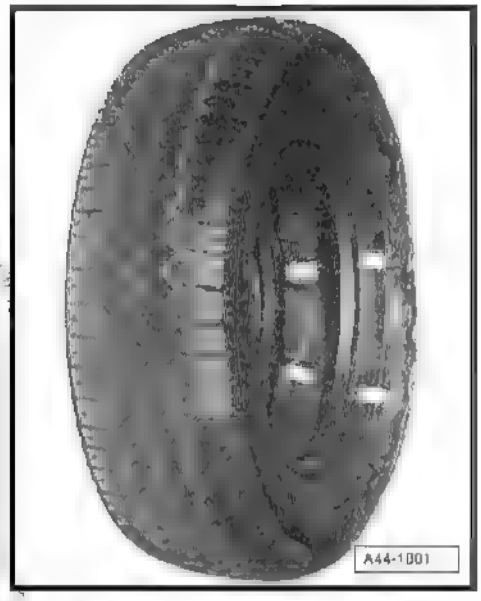
With a reduced air pressure and consequently a more accentuated flexion (inner friction), the materials of the tyres warm up in such a way that there may be the separation of the different components of the frames from rubber mix.

Most of times, the final result is the complete destruction of the tyre ⇒ page 33 .

It's not always possible to determine the cause of the slow loss of pressure, because the tyre is very damaged and the components the tyre frame do not exist anymore.

2.5.8 Damages to the tyres due to insufficient air pressure

The most frequent causes of failures are outer small damages, a valve in bad condition, or a wheel that does not seal due to corrosion or damages.

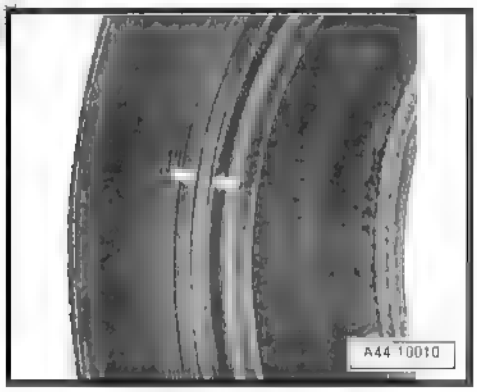


Separation of rubber case

Strong warm up due to driving under low pressure ⇒ page 34 led to overheating and the corresponding separation of the rubber material from the case -arrows-.

The tyre showed on the Figure A was used during some time with an insufficient air pressure for the load. The vestiges characteristic for this condition are the wear areas and the whole turn of the tyre bead due to wheel flap and colouration. Small corrugated folds are visible from the side inner wall.

When turning the tyre, high shearing forces between the steel wire layers, particularly at the ends of the mesh, can be noticed.



Tyres with wide depressions around them at the tyre bead area

Wide depressions around the bead area -arrows- are evidences of driving with insufficient air pressure.

When the vehicle is driven with insufficient air pressure, or when damages in the tyres are detected, or when these damages are ignored, the consequences may be serious.

The tyre has not absorbed the forces that are formed while the vehicle is in motion.

Due to the mentioned damages, the function of the tyre is strongly limited. The mixes of rubber separate one from the other, and the components of the tyre are partially released until its complete destruction.

Tyres with torn tread

The progress of these type of damage usually extends during a wide period of time. If a damaged tyre is subject to great requests, there may happen a tear of the components of the tyre, due to centrifugal force under high speed.

The figure shows a tyre with torn tyre tread, because the vehicle was driven with insufficient air pressure

2.5.9 Rise of temperature in tyres with insufficient air pressure

The chart shows the behaviour of the temperature of a tyre at a speed of 180 km/h

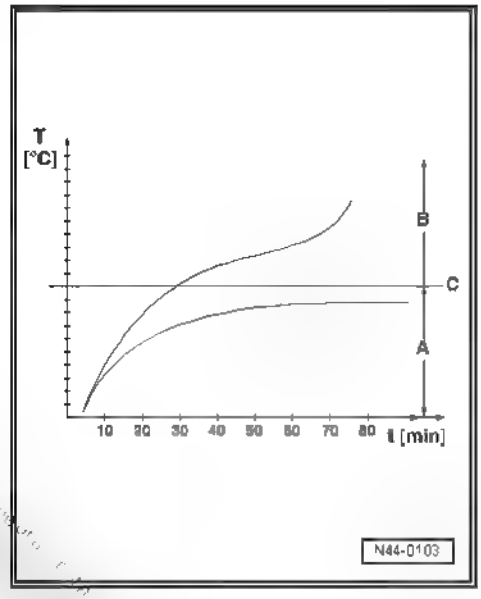
A - Normal amplitude: when the recommended air pressure is kept, the temperature remains balanced

B - Danger area: If a pressure 0.3 bar lower than the specified air pressure is used, at higher speeds, the temperature rises at more than 120°C

C - Critical temperature limit: beginning of tire damages.

T - Temperature in °C

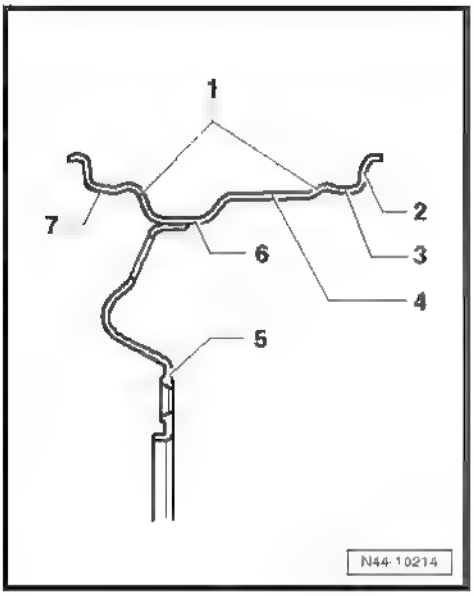
t - Driving time in minutes



2.5.10 Damages to the tyres due to assembly failure (assembly damages)

Bead core broken while inflating the tyre

The updated radial tyre for passenger vehicles are exclusively assembled in safety wheels. These wheels have an elevation around the shoulders -1-.



1 - protrusion (double protrusion H 2)

2 - flap of the wheel

3 - inner shoulder of the wheel (for example, inclined shoulder)

4 - wheel

5 - central disc of the wheel

6 - base

7 - outer shoulder of the wheel (for example, inclined shoulder)

The protrusion avoids the compression of the tyre by wheel shoulder if the vehicle is driven with insufficient inflation pressure.

When inflating the tyre, it may happen that the tyre bead does not slide completely over the wheel's protrusion.

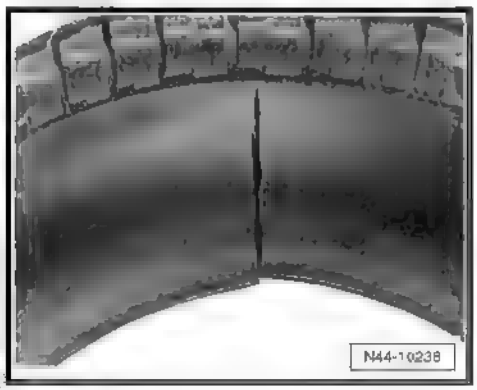
In this case, there is the danger of bead core dilatation, due to excessive inflation pressure, when the corresponding steel wires break totally or partially. The slots in the tyre bead core are not detectable from the outer portion.

WARNING

- *The tyres with damaged bead core do not have a good seating on the wheel. These tyres represent a danger for the safety!*
- *Moreover, there is the danger of a bead core partially damaged breaking completely, while the vehicle is being driven, and the tyre may suddenly open. If the bead core breaks while the tyre is being inflated, the case will also be destroyed.*

Tyre with damaged tyre bead core and destroyed case

The figure shows a tyre with the bead broken and the case destroyed due to excessive stress during the assembly.



Damages in the tyre bead caused by deficient or incorrect assembly with assembly machines

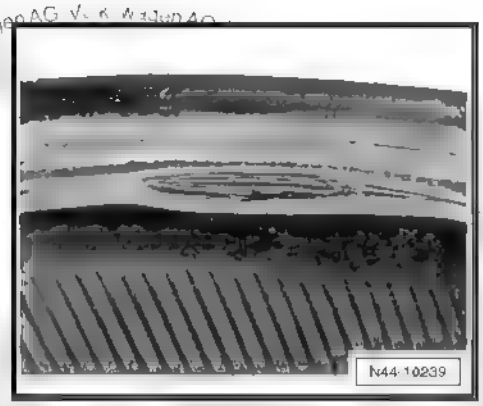
The following failures that happened during the assembly of the tyres may cause serious consequences to the tyres:

- when inserting the upper bead of the wheel, at the tyre assembly machine, the tyre bead on the opposite side does not seat completely to the base ➢ page 35
- when the assembly head was misadjusted
- when the edge of the assembly roll slides on the bead roll.
- when the guide rolls are worn and with pointed edges

Tyre with damaged bead

In these cases, the bead subject to great stress may be cut in the axial direction, damaged and/or compressed up to the wire of the core

Frequently, vestiges of seat and sliding of the glide roll at the machine are detected at the damaged area.



Note

Both tyre beads and the wheel shoulders shall be always lubricated with Assembly paste - G 052 109 A2- . Refer to the ⇨ Chemicals Manual

If imperceptible assembly damages remain, there is the danger of rendering the tyre useless later, during driving.

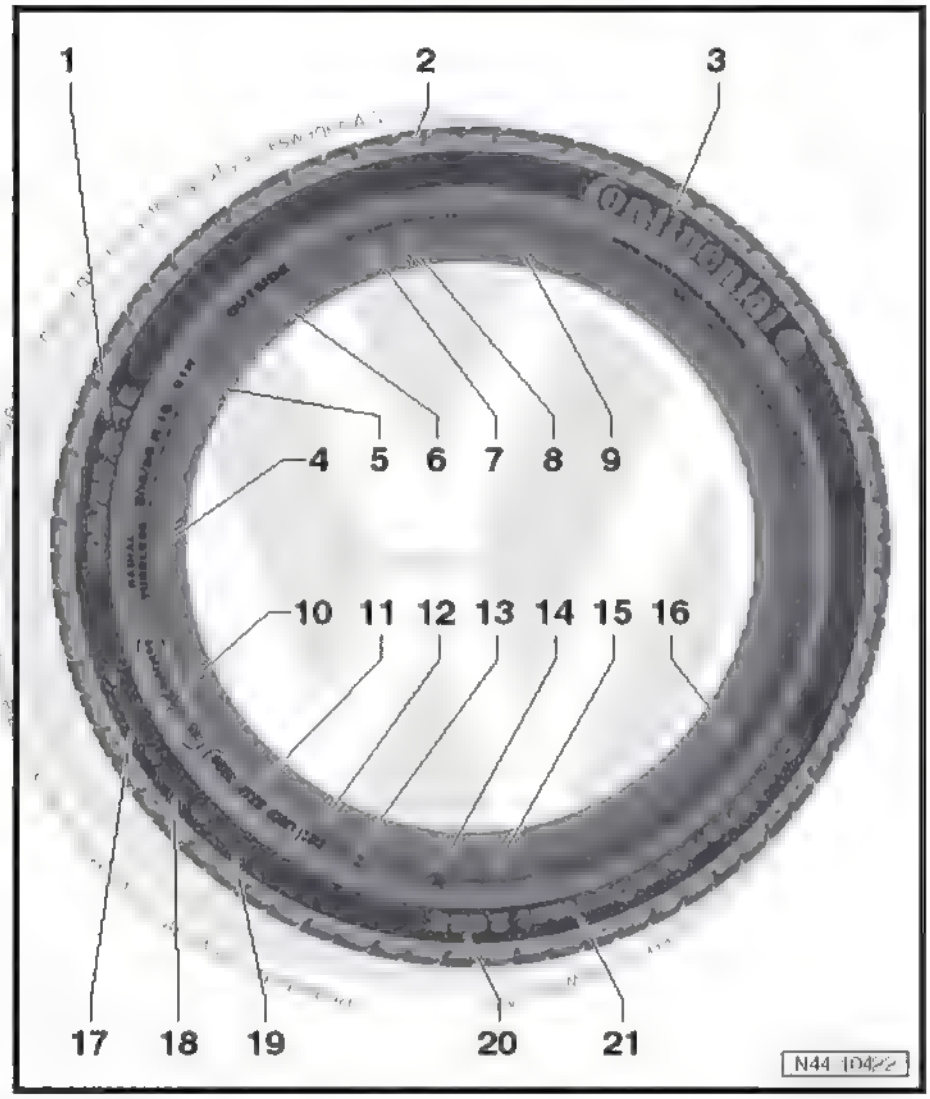
FOR THIS REASON!

- Never assemble without Assembly paste - G 052 109 A2- .
- Do not inflate the tyres with more than 3 bar, in order to make the thrust to the wheels.
- Never inflate the tyres with more than 4 bar.
- At the end of the assembly operations, reduce the air pressure to the specified value.

2.6 Useful notes related to tyres and wheels

2.6.1 Inscriptions on the side wall of the tyre

Example: Dunlop SP Sport 9000



1 - Size

for example 205/55 R16

2 - Position of wear indicators TWI (Tread Wear Indication)

3 - Manufacturer (trade name)

4 - Structure

Radial - radial wearing in the case

Tubeless - Marks for tubeless tires

5 - Load capacity coefficient/ speed identification letters

for example 91. H

6 - Tire assembly position/rolling direction indication

7 - Maximum load permitted

Exclusive data for North America

8 - Maximum tire pressure permitted

Exclusive data for North America

9 - Number of grooves in the center of the rolling surface and sidewalls, as well as material data

10 - E-number = license indication

The tire is compliant with European standards

11 - Manufacturer code/manufacturing date

Manufacturer identification number, tire size and execution

Tire maturity/manufacturing date

12 - DOT - Department of Transportation

The tyre meets the guidelines of North-American traffic authorities

13 - Brazilian indication - Inmetro seal

14 - China indication

15 - Manufacturing country

e.g. Made in Brazil

16 - Tire use or assembly safety instructions

17 - Relative useful life - Resistance to friction

regarding a specific US test

18 - Wet braking behavior assessment A, B, or C

as per specific US test

19 - Temperature resistance assessment A, B, or C

as per specific US test

20 - Indications in tires with emergency operation characteristics

for example Self-Supporting Runflat

21 - Designation of profile

for example ContiPremiumContact

2.6.2 Clarifications about tyre inscriptions

Clarifications about tyre dimensions

Tyre	Speed	1	2	3	4	5	6	7
Tyres	up to 240 km/h	195	65	R	15	91	V	-

1 - Width of tyre

2 - Height of profile in % of width

3 - Tyre type letter "R" (it means Radial)

4 - Designation of wheel diameter

5 - Load capacity code/Loadindex (LI)

6 - Speed identification letter

Maximum speed/speed identification letters

Speed identification letter	Maximum speed in km/h
L	120
M	130
N	140
P	150
Q	160
R	170
S	180
T	190
U	200
H	210
V	240
ZR	more than 240
W	270
Y	300

Load capacity code/Loadindex (LI)

The load capacity code is referred on the tyre side wall. This code indicates the allowable maximum load that the tyre can support.

The weight capacity code is indicated on the tyre dimension designation, e g. 195/65 R 15 91T. It is indicated on the tyre as a code according to ETRTO rule. The following table shows the load capacity codes used by VW with the corresponding capacities

Load capacity code	Tyre maximum load capacity in kg
75	387
78	425
79	437
80	450
81	462
82	475
83	487
84	500
85	515
86	530
87	545
88	560
89	580
90	600
91	615
92	630
93	650
94	670
95	690
96	710
97	730
98	750
99	775
100	800
101	825
102	850
103	875
104	900
110	1060
112	1120

2.6.3 Contractions

The contractions are small cavities on the tyre's side tread.

They extend from tyre bead to tyre shoulder. The figure shows the referred components ⇒ page 25 .

It is a super elevation of material in the composition of tyre components.

The contractions do not exert any influence related to:

- safety,
- useful life,
- vehicle behaviour or
- other features of the tyre.

The contractions can present different intensities. It is not required the removal of the tyre from the wheel or performing an inspection.

What is the cause of contraction's build-up?

By reason of weight, the modern tyres with interlaced steel wire mesh are made mainly with a side wall of only one layer.

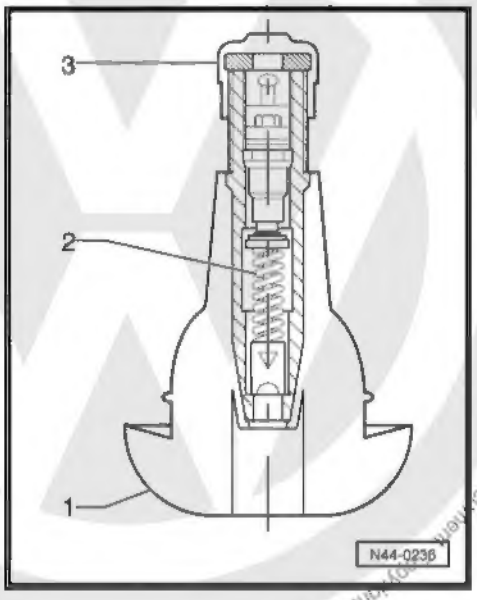
The components of side wall are formed by elongated bands before being matched in a tyre. These bands shall get overlaid in the combination of material. It produces small irregularities/waves in the overlaid component zone. Due to the single layer's structure, these overlaying are slightly visible up from the exterior.

2.6.4 Rubber valve

1 - Valve body

2 - Valve inner portion

3 - Valve cap



1. Valve body

The rubber valve for tubeless tyres was conceived in order to hermetically close the rim hole. The elastic material of rubber body is pressed in order to get secured in the rim hole.

The wheel sealing is made by a rubber gasket in the threaded metal-based valves. The side surfaces of valve hole are sealing zones. On that account they shall be free of rust, dirtiness and damages.

2. Valve inner portion

The valve inner portion performs the most important task. It seals and allows the air pressure adjustment. The small disc gasket on the valve's inner portion can perform this function if it is free of impurities or dirtiness from moisture. The air filling systems have to be free of water and oil!

3. Valve cap

All valves shall be always capped. This cap prevents dirt from penetrating the valve. The dirty occasionally existent in the valve would reach the valve's gasket, causing air leaks.

The valve has to be replaced every time the tyre is reassembled.

If the vehicle is driven when the valves are not capped, there will be the risk of dirt penetration. It causes a slow loss of air and this way it can lead to tyre's destruction:

- Separation of rubber case ⇒ page 33
- Wide round grooves on the tyre bead area ⇒ page 33
- Damaged tyre tread ⇒ page 33

> **WARNING**
>
> *Only with the valve cap well tightened it is possible to assure a hermetic closing.*

2.6.5 Storage of tyres

Storage

The tyre storage place must be:

- dark,
- dry,
- cool and

- ventilated

.

> **WARNING**
>
> *During the tyre storage period, the tyres shall not be in contact with fuel, oil, grease and chemical products. Otherwise, the tyre would be damaged by chemical processes that are not always visible.*
>
> *This way, we may notice a risk condition during driving.*

The chemical products cause damages to the tyres only after a long period of acting. If, during the refuelling, the tyre is reached by some fuel drops, such condition is not worrying.

Storage of tyres

Complete wheels

The rims with assembled tyres can be stored in horizontal overlapping. The wheels must be clean and dry. The air pressure shall be raised up to the maximum measure of 3 bar.

Tyres without wheels

Preferably store the tyres without rim vertically. If the tyres are stored on top of each other over an extended period of time, they will be strongly compressed, which will turn their mounting on the wheel more difficult, because the tyres will not adjust to the rim beads. It is recommendable a tyre rotation every 15 days, in case of vertical storage, in order to avoid an outstanding flattening.

2.6.6 Aging of tyres

The tyres get old due to chemical and physical processes that damage their function. The tyres stored without use for a long period of time get hard and fragile quicker than the tyres that are permanently used in a vehicle. Old tyres may present aging cracks with the thickness of a hair. The plastifier in the rubber is activated due to flexion process in those tyres that are continuously used, thus avoiding the hardening and crack build-up.

This way, attention should be paid to the tread depth and to the age of tyres in the spare tyres, storage tyres and other tyres. The age of the tyre can be read on DOT designation. It includes de tyre production date, among other things.

Example of a DOT number until 12.31.1999

DOT	5 0	9	[It] means 199_
		year of production last figure	
	number of calendar week		

In this example, the manufacturing date is the 50th week of 1999.

Example of a DOT number up from 01.01.2000

DO ..... T	0 1	0 0 Year of manufacturing, last two figures
	number of calendar week	

In this example, the manufacturing date is the 1st week of 2000.

Recommendation

- We recommend the use of tyres that are more than 6 year-old only in case of emergency and with careful driving.
- In case of new tyre assembly, the spare tyre may be used if it is in perfect conditions and if it is not older than 6 years-old. The age of the tyres influence the strength when driving the vehicle fast. The arrangement of a spare tyre with new tyres is possible, but it may influence the behaviour of the vehicle while driving it.
- The tyres take a constant evolution, and this fact shall lead to small differences in the mix of the rubber, including when it is a product of the same brand, dimensions and floor.
- All VW vehicles have plant-installed four similar wheels and tyres.

Front-wheel drive vehicles:

- For safety reasons, during the driving, in the same axis, tyres of the same brand and with the same tread shall be used.

Integral-wheel drive vehicles:

- The integral-wheel drive vehicles shall be equipped with four wheels and tyres with the same dimensions, type of construction, tyre tread and brand.

Change of tyres

The tyres shall be always changed, if:

- the legal minimum depth of 1.6 mm for the floor is reached,
- there are visible damages due to mechanical action,
- if the tyres are older than 6 years.

2.6.7 Tyre rotation

In vehicles equipped with front traction, due to high effort of the front wheels, an accentuated wear can be noticed on the front axle wheels.

In order to keep the same useful life on the 4 tyres of the vehicle, we recommend the change of the front wheels backwards and vice versa.

Pay attention to the rolling direction of the tyre, because it cannot be reversed.

As the tyre rolls in the same position, it adjusts and, therefore it is recommendable the change of the wheels at short intervals, for example, every 5,000 km.

Only in case of tyres without rolling direction it is possible to change the tyres diagonally. This change of tyres represents an additional advantage in case of saw teeth build-up ⇒ page 16 .

If the saw teeth build-up is great, and the tyre tread is more than 50% worn out, only a little improvement will be possible and the change will not be worth. The elasticity of the profile blocks reduces and the saw tooth increases.

2.6.8 Notes related to assembly in case of replacement/assembly of wheel

WARNING

The correct attachment of wheel bolts and wheels is assured only if the following inspections/indications are followed:

The inspections/indications described below shall be performed when the wheel is removed!

1. Check if the seating surfaces of brake discs/brake drums and wheels are free of corrosion and dirt.

   The wheel [5] hubcaps and the wheel studs shall also be free of oil, grease, corrosion and dirt.

- If required, remove all evidences of oil, consistent mass, dirt and corrosion.

2. Check if the wheel centering hole and the centering of wheel hub are free of corrosion and dirt.

- If required, remove the dirt and the corrosion.

3. Check if the wheel studs can be screwed manually without any difficulty. The wheel stud threads cannot contact the brake disc holes.

   If the wheel stud thread touches the hole, it will be necessary to roll the brake disc into conformity.

- Clean the dirty wheel studs with a wire brush, for example.

WARNING

The corroded and/or damaged wheel studs must be replaced!

Assembly of the wheel

1. When assembling the wheel, screw all screws manually and evenly.

2. Tighten the screws on a crisscross pattern, with approximately 30 Nm, for example, with a crisscross wheel wrench.

3. Tighten all wheel bolts on a crisscross pattern with the recommended tightening torque, with the vehicle on the floor.

WARNING

Never use power wrenches to install wheels.

5) Wheel hubcap is the round surface of a ball section. The wheel hubcap is installed to the wheel with the wheel stud, in the hole for the wheel stud.